
INDEX

A

A-B-C approach to classifying inventory, 256–258
accounting systems for inventory management, 254–255
accuracy
 of forecasting, 10–11, 12, 39–42
 of naive forecasts, 15
 of work sampling, 137
activity on arc (AOA), 314–315
activity on node (AON), 314–315
acuity-adjusted standards, 155–156
acuity-based workload standards, 166–167
additive model of seasonality, 33
aggregate forecasts, 10–11
allocation of resources
 integer linear programming and, 235–239
 linear programming and, 227–229
 maximization models, 229–235
 minimization models, 235, 236, 237

allowance factor, 130, 131
alternative forms,
 evaluation of, 186
alternatives, developing, analyzing, and comparing, 50–51
American Association of Critical-Care Nurses, 170
American National Standards Institute, 275
annual holding cost, 260
annual ordering cost, 260
AOA (activity on arc), 314–315
AON (activity on node), 314–315
arrival patterns, 350–352, 353
Atlanta health care market, 79–80
Atlas of Cancer Mortality, 96, 97
attributes, control charts for, 283–286, 287
averaging techniques
 moving average (MA), 15–19
 naive forecast, 14–15
 overview of, 13–14
 single exponential smoothing (SES), 22–25
 weighted moving average (WMA), 19–22

B

Baldrige Award, 275
balking, 354
bar coding, 221–222, 254–255
batch inventory system, 254
bedside scanning system, 255
behavioral management school, 126–127
benchmarking, 197, 298
beta distribution, 321
binding constraints, 232
block scheduling method, 188–189, 190–191
bounded rationality, 51
brainstorming, 296
break-even analysis, 81–84

C

capacity costs, 346–347
capital inputs, 221
carrying costs, 253, 256, 260–262
case-mix, 199
case-mix adjustment, 207–209
cause-and-effect diagrams, 300, 301
c-charts, 281, 283–284, 285

- center-of-gravity method, 91–94
 certificate of need, 80
 channels, 349
 charts
 c-, 281, 283–284, 285
 charts, 286, 287–291
 closeness rating, 105, 106
 flow, 144–146, 300, 301
 flow process, 144, 145
 from-to, 108–112
 Gantt, 311–313
 mean, 281
 p-, 281, 283, 284–286, 287
 Pareto, 300, 302
 range, 281, 286, 288, 291
 work distribution, 142–144
 See also control charts
 check sheets, 298, 299
 classification system for inventory
 management, 256–258
 closeness rating charts, 105, 106
 compensating employees, 147
 computerized inventory
 management, 250
 Computerized Relative Allocation
 of Facilities Technique, 112
 computerized scheduling, 185, 193
 computerized simulations, 383
 constraints, 227, 228, 232
 continuous quality improvement
 (CQI), 122, 277–278
 control charts
 for attributes, 283–286, 287
 overview of, 281–282
 patterns in, 292–296
 run-based pattern tests, 292–294
 sensitizing rules for, 295–296
 for variables, 286–291
 zone tests, 294–295
 conversion process, 273
 cost containment, 5
 cost information and inventory
 management, 256
 cost of labor adjustment, 204
 cost payoff tables, 63–64
 cost-profit-volume (CPV) analysis
 method, 81–84
 costs
 minimizing, 108–112
 minimum total, 261
 of ordering and carrying
 inventories, 253, 256, 260–262
 project compression and, 329–335
 queuing models and, 346–347,
 361–363
 of scheduling, 178
 service capacity and, 347
 total, 260–261
 waiting, 347
 cost savings and facility layout, 103
 coverage, 177
 coverage factor; calculating, 167–168
 CPV (cost-profit-volume) analysis
 method, 81–84
 CQI (continuous quality
 improvement), 122, 277–278
 Critical Path Method (CPM)
 ES and EF times, computing,
 317–318
 LS and LF times, computing,
 318–319
 overview of, 313–314, 315–317
 Crosby, Philip B., 275
 cumulative Poisson probabilities,
 393–396
 cycle, definition of, 13, 14
 cycle time, 104
 cyclical work schedule, 182, 183
- ## D
- daily indices technique, 37
 Dartmouth Atlas of Health Care, 95
 data, variations in, 13–14, 280
 databases for inventory
 management, 250
 data collectors, training for work
 sampling, 136–137
 Data Envelopment Analysis (DEA),
 217–220
 decision analysis with nonmonetary
 values and multiple attributes,
 68–70
 decision making
 cost payoff and, 63–64
 definition of, 49
 expected opportunity loss, 61
 expected value model, 60–61
 expected value of perfect
 information (EVPI), 61–63
 Hurwitz strategy, 55–56
 Laplace strategy, 57–58
 level and milieu, 52
 maximax strategy, 53, 55
 maximin strategy, 52, 54
 minimax regret strategy, 53,
 56–57, 63–64
 payoff table, 53–54
 problems in, 51–52
 process of, 49–51
 risk and, 58–60
 uncertainty and, 52–53
 See also decision techniques;
 decision tree; locating facilities;
 simulation
 decision making units (DMUs),
 217–218
 decision techniques
 health care manager and, 6–7
 history of, 2
 information technology and, 3
 overview of, 1–2
 decision tree
 description of, 64
 rollback procedure and, 64–65,
 66, 67
 software illustration of, 65–67
 decision variables, 228
 Delphi method, 12–13
 demand analysis, 80
 demand rate, 259
 Deming, W. Edwards, 275
 Deming Prize, 275
 Deming wheel/Shewhart cycle, 277
 dependency relationships, 313
 depletion rate, 259
 direct care activity, 161
 direct care hours productivity
 measures, 209–212
 direct observation, 170
 discipline, of queue, 354
 discretionary work systems, 182,
 184–185
 distances, minimizing, 108–112
 distributors for medical supplies,
 246–247
 DMADV (define, measure, analyze,
 design, and verify), 278–279
 DMAIC (define, measure, analyze,
 improve, and control), 278–279
 DMUs (decision making units),
 217–218
 dominance procedure, 69, 89–90
 dominant critical path, 327
 dynamic block scheduling
 method, 189

E

EBCCT (electron beam computed tomography), 82
 economic efficiency, 216–217
 economic order quantity (EOQ) model, 258–265
 economic order size, 254
 EDI (electronic data interchange), 246–247, 255
 e-distributors, 248
 education of staff, 221
 effectiveness, definition of, 215
 efficiency
 Data Envelopment Analysis (DEA) and, 217–220
 definition of, 215
 economic, 216–217
 technical, 215–216
 eight-hour shift, 178–182
 80/20 rule, 162
 elasticity zone, 168, 169
 electron beam computed tomography (EBCCT), 82
 electronic data interchange (EDI), 246–247, 255
 empirical distribution, 377
 employee acceptance, 186
 employee contact, 170
 EOQ (economic order quantity) model, 258–265
 errors
 mean absolute percent error (MAPE), 40–42
 minimizing, 273–274, 278
 Type I and Type II, 282
 estimating procedure times, 192–193
 estimation method, 162
 Euclidian distance, 112
 Excel-based simulation, 383–384
 expected opportunity loss model, 61
 expected value model, 60–61
 expected value of perfect information (EVPI) model, 61–63
 expenditures on health care services, 4
 exponential smoothing,
 trend-adjusted, 30–33, 34
 external work standards, 169–171

F

facilities. *See* layout of facilities;
 locating facilities
 factor analysis system, 156–157
 factor rating methods, 85–88
 feasible solution space, 231
 finite source, 348
 first come/first served
 as queue rule, 354
 as scheduling method, 188
 5W2H approach, 296
 fixed activity, 161
 fixed-position layout, 113
 flexibility of schedule, 178
 flexible scheduling, 182, 184–185
 flexible staffing methodologies, 152
 flex week, 182
 flow charts, 144–146, 300, 301
 flow of materials in supply chain, 248–249
 flow process charts, 144, 145
 focus groups, 297
 forecast error, 39–42
 forecasting
 accuracy of, 39–42
 control of, 42–44
 elements of, 10–11
 exponential smoothing,
 trend-adjusted, 30–33, 34
 judgmental forecasts, 12–13
 linear regression, techniques
 based on, 25–30, 31
 seasonal indices and, 37–39
 seasonality and, 33–36
 steps in process of, 11–12
 uses of, 10
 See also averaging techniques
 from-to charts, 108–112
 functionality of facility layout, 102

G

gain sharing plan, 147
 Gantt, Henry, 2
 Gantt charts, 311–313
 generating new ideas, methods for,
 296–298
 geographic information systems (GIS), 95–96, 97
 geographic position of facility,
 91–94

Gilbreth, Frank and Gillian, 2, 125
 goal of forecast, identifying, 11
 graphical approach to linear programming, 231–232, 235, 236
 graphing data, 13
 GRASP system, 157–158
 group purchasing organizations (GPOs), 247–248

H

handheld order entry systems, 4–5
 Harris, F. W., 2
 health care institutions,
 performance of, 121
 health care manager
 decision techniques and, 6–7
 responsibilities of, 3
 health care services, characteristics of, 7–8
 health care system, mis-utilization, overutilization, and underutilization of, 274
 Health Industry Business Communications Council, 255
 heterogeneity of health care, 8
 histograms, 298, 299
 historical averaging method, 162, 192–193
 historical benchmarking, 197
 historical times, 132
 holding costs, 253, 256, 260–262
 hours of direct care, 209
 hours per patient day (HPPD), 197, 200–201
 human relations school, 126
 human resources, 123–124, 154
 Hurwitz decision strategy, 53, 55–56

I

ideas, methods for generating, 296–298
 IDS (integrated delivery system) movement, 3, 5
 implementing new system of scheduling, 185–187
 incentive-based system for compensating employees, 147
 indirect activity, 161–162

- industry standards, 169
 - infinite queue, 354
 - infinite source, 348
 - infinite-source queuing models
 - formulations, 356
 - multi-channel, 360–363
 - overview of, 355–356
 - single channel, 357–360
 - information technology
 - decision making and, 3
 - productivity and, 221
 - inputs
 - definition of, 7, 196
 - quality of, 212, 221
 - inputs, adjustments for
 - cost of labor, 204
 - hours, 202–203
 - overview of, 201–202
 - skill-mix, 202
 - standardized cost of labor, 204–205
 - insufficient reason principle, 57–58
 - intangible nature of outputs, 8
 - integer linear programming, 235–239
 - integrated delivery systems (IDS)
 - movement, 3, 5
 - inter-arrival time, 351–352
 - internal workload standards
 - coverage factor, 167–168
 - determination of FTEs for nurse staffing, 166–167
 - overview of, 161–163
 - reallocation through daily adjustments, 168–169
 - utilization of FTEs, 163–165
 - International Organization for Standardization (ISO), 275–276
 - interviewing, 297
 - inventory
 - definition of, 252
 - functions of, 253
 - safety stock, 266
 - See also* inventory management; supply chain
 - inventory cycle, 258–259
 - inventory management
 - accounting systems for, 254–255
 - classification system for, 256–258
 - cost information and, 256
 - economic order quantity (EOQ) model, 258–265
 - just-in-time (JIT) and stockless inventories, 250–251
 - lead time and, 255–256
 - overview of, 249–250
 - reorder point, 259, 265–267
 - requirements for effective, 253–254
 - single versus multiple vendors, 251–252
 - traditional, 252–253
 - iso-cost constraint, 217
 - ISO (International Organization for Standardization), 275–276
 - iso-objective function line, 231
 - isoquant, 216
- J**
- JIT (just-in-time) inventory, 250–251
 - job design, 125–128
 - job enlargement, 126
 - job enrichment, 126
 - job rotation, 126
 - job satisfaction
 - flexible scheduling and, 185
 - productivity and, 127, 172
 - of surgeons, 187
 - Joint Commission on Accreditation of Healthcare Organizations, 276
 - joint probability, 322, 325–327
 - judgmental forecasts, 12–13
 - Juran, Joseph M., 275
 - jury of executive opinion
 - method, 13
 - just-in-time (JIT) inventory, 250–251
- K**
- “Kaizen teams,” 297–298
- L**
- labor costs, 214
 - labor hours adjustment, 202–203
 - Laplace decision strategy, 53, 57–58, 59
 - layout of facilities
 - fixed-position layout, 113
 - planning, 102–103
 - process layout, 104–112
 - product layout, 103–104
 - total cost (TC), calculating, 111
 - lead time and inventory
 - management, 255–256
 - length of order cycle, 261
 - level of service and inventory
 - management, 253, 267
 - life cycle of project, 309
 - limited-capacity queue, 354
 - linear programming
 - integer type, 235–239
 - maximization models, 229–235
 - minimization models, 235, 236, 237
 - overview of, 227–229
 - linear regression
 - forecasting techniques based on, 25–30, 31
 - as trend line, 29–30, 31
 - locating facilities
 - center-of-gravity method, 91–94
 - certificate of need and, 80
 - cost-profit-volume (CPV) analysis method, 81–84
 - factor rating methods, 85–88
 - factors in, 79, 81
 - geographic information systems (GIS) and, 95–96, 97
 - marketing strategy and, 80
 - multi-attribute methods, 89–91
 - software solution for, 95, 96
 - as strategic decision, 80–81
 - logging method, 162–163
 - longest case first scheduling method, 189
 - lower confidence level (LCL), 280–282
- M**
- MAD (mean absolute deviation), 40–42
 - MA (moving averages), 15–19
 - managed care programs, 5
 - management
 - of supply chain, 249
 - See also* health care manager; inventory management; project management; workload management

- Manhattan distance, 112
- manufacturers of medical supplies, 245–246
- MAPE (mean absolute percent error), 40–42
- maximax decision strategy, 53, 55
- maximin decision strategy, 52, 54
- maximization models of linear programming
graphical approach, 229–232
simplex method, 232–235
- mean absolute deviation (MAD), 40–42
- mean absolute percent error (MAPE), 40–42
- mean charts, 281, 286, 287–291
- medical devices, 246
- Medical Group Management Association, 276
- medical-surgical companies, 246
- Medicare Prospective Payment System (PPS), 196
- medication errors, 274
- Medicus Systems Corporation, 158
- minimax regret decision strategy, 53, 56–57, 63–64
- minimization models of linear programming, 235, 236, 237
- minimizing
costs and distances, 108–112
errors, 273–274, 278
- minimum attribute satisfaction procedure, 69–70, 90
- minimum total cost, 261
- mis-utilization of health care system, 274
- monitoring
control charts and, 281–282
new scheduling system, 186–187
processes for quality, 280
results, 51
- Monte Carlo simulation technique
empirical distribution, 377
performance measures for, 382–383
process of, 376–377
random number look-up, 378–381
theoretical distribution, 378
- monthly indices technique, 36–37
- most important attribute procedure, 70, 91
- most likely time, 320
- moving averages (MA), 15–19
- multi-attribute decision making, 68–70, 89–91
- multifactor productivity, 198
- multiple-line systems, 349–350
- multiple room scheduling system, 189, 192
- multiple sourcing, 251, 252
- multiplicative model of seasonality, 33–34
- ## N
- naive extrapolation method, 13
- naive forecasts, 14–15
- nanotechnology, 222
- National Drug Codes, 255
- negative exponential distribution, 352–353
- network representations, 314–315
- nominal group technique, 297
- non-binding constraints, 232
- nonmonetary values, decision analysis with, 68–70
- nonrandom variations in data, 280
- normal time, 129–130, 133
- Novation, 247–248
- Nursing Productivity and Quality System (NPAQ), 158–161, 185
- ## O
- objective function, 228
- objective probability estimation, 58–59
- observation
direct, 170
random schedule for work sampling, 138–142
- observed time, 129, 132, 133
- observers, training for work sampling, 136–137
- Oncology Nursing Society (ONS), 169, 170
- on-line inventory system, 254
- operating room use, assessing, 187–188
- opportunity loss table, 56–57
- optimal solution, 231
- optimistic time, 320
- ordering costs, 256, 260–262
- outcomes
control charts and, 281–282
quality and, 272–273
Outcome Standards for Cancer Nursing Practice, 169–170
- output-based system for
compensating employees, 147
- outputs, adjustments for
case-mix, 207–209
overview of, 205–206
service-mix, 206
- outputs, definition of, 7, 8, 196
- overclassification, 211–212
- overstocking, 252–253
- overutilization of health care system, 274
- ## P
- pair-wise comparisons, 69
- parameters, 228
- Pareto charts, 300, 302
- Pareto principle, 122
- partial productivity measure, 198
- part-time work, 184
- path, 316
- patient acuity systems
GRASP, 157–158
Nursing Productivity and Quality System (NPAQ), 158–161
overview of, 155–157
- patient-focused care, 122–123
- patient participation, 7
- payoff tables, 53–54
- p-charts, 281, 283, 284–286, 287
- percentage of adjusted hours in direct care, 210
- percentage of hours in direct care, 210
- performance
of health care institutions, 121–122
of queuing systems, 355
simulation and, 384–385
- periodic inventory accounting system, 254
- perishable capacity, 8
- perpetual inventory accounting system, 254
- PERT (Program Evaluation and Review Technique), 313–314

pessimistic time, 320
 pharmaceutical sales, 245–246
 physical environment, 128
 pilot testing, 186
 Plan-Do-Study-Act model, 277
 planning projects, 311–314
 plan of action for decision making, 50
 Poisson distribution, 352–353, 378, 380, 393–396
 population source, 348–349
 precedence relationships, 313
 predetermined standards, 134
 Premier, 247, 248
 prime vendor, 250
Principles of Scientific Management, The (Taylor), 2
 probabilistic approach, 320–327, 328
 problems, identifying, 50
 procedure-based workload standards, 163, 164–165
 procedure times, estimating, 192–193
 process improvement
 generating new ideas, 296–298
 investigating for presence of quality problems, 298–302
 process layout
 computer-based programs for, 112–113, 114
 minimizing distances and costs, 108–112
 overview of, 104
 tools for designing, 104–108
 process variability, 279–281
 productivity
 Data Envelopment Analysis (DEA), 217–220
 definitions and measurements of, 196–199
 dilemmas of, 214–215
 direct care hours measures and, 209–212
 improving, 220–222
 inputs, adjustments for, 201–205
 job satisfaction and, 127
 Medicare Prospective Payment System and, 196
 multiple dimensions of, 215–217
 outputs, adjustments for, 205–209
 overview of, 195
 quality and, 212–214

ratios, 199–201
 workload management and, 171–172
 product layout, 103–104
 professional standards, 169–170
 profit sharing plan, 147
 Program Evaluation and Review Technique (PERT), 313–314
 project compression, 327, 329–335
 project management
 Critical Path Method, 315–320
 network representations, 314–315
 overview of, 308–309
 planning and scheduling issues, 311–314
 probabilistic approach, 320–326
 team and relationship issues, 310–311
 project manager, 310
 projects, life cycle of, 309
 prototype acuity system, 156
 Public Law 100-203, 221
 purchasing, single versus multiple vendors, 251–252

Q

quality
 certifications and awards for, 275–276
 Data Envelopment Analysis (DEA) and, 220
 definition of, 272–273
 experts in, 275
 factors affecting, 214
 gaps in, 273–274
 of inputs, 212, 221
 investigating presence of problems in, 298–302
 productivity and, 196, 199, 212–214
 programs for improving, 274–275, 276–279
 See also quality measurement and control techniques
 quality circles, 297–298
 quality gaps, 273–274
 quality measurement and control techniques
 control chart patterns, 292–296
 control charts, 281–282
 control charts for attributes, 283–286

control charts for variables, 286–291
 process variability, 279–281
 quarterly indices technique, 36
 queue characteristics, 354–355
 queuing models
 arrival patterns, 350–352, 353
 characteristics of, 348
 costs and, 361–363
 infinite-source, 355–363
 measures of system performance, 355
 number of servers, 349–350
 overview of, 345–347
 population source, 348–349
 queue characteristics, 354–355
 service patterns, 352–353

R

random observation schedule for work sampling, 138–142
 random variations in data, 13–14, 280
 range approach to mean charts, 289–291
 range charts, 281, 286, 288, 291
 range of feasibility, 234
 reallocation of human resources, 154
 recruitment, 172
 rectilinear distance, 112
 reducing staff, 121–122
 reengineering
 description of, 122
 early example of, 122–123
 human resources management and, 123–124
 retraining staff and, 123
 work design and, 124–128
 regression analysis, 25–30, 31
 relationships, managing on projects, 310–311
 reneging, 354
 reorder point (ROP), 259, 265–267
 resource allocation
 integer linear programming and, 235–239
 linear programming and, 227–229
 maximization models, 229–235
 minimization models, 235, 236, 237

restructuring, 5
 retention, 172
 return on investment (ROI), 249
 risk in decision milieu, 52, 58–60
 ROP (reorder point), 259, 265–267
 run-based pattern tests, 292–294

S

safety stock, 266
 satisfaction surveys, 272–273
 scanning system, bedside, 255
 scatter diagrams, 298–300
 schedule quality, 177–178
 scheduling
 procedures, 154, 172
 projects, 311–314
 See also surgical suite scheduling
 scheduling staff
 computerized systems for, 185, 193
 cyclical, 182, 183
 factors in, 177–178
 flexible, 182, 184–185
 implementing new system of,
 185–187
 integer linear programming and,
 235–239
 shift length and, 178–182
 See also staffing
 scientific management approach,
 2, 125–126
 scope of health care services, 4–5
 seasonal indices
 description of, 33–34
 employing in forecasts, 37–39
 seasonality
 definition of, 13, 14
 techniques for, 33–36
 self-reports of work activity, 137
 sensitizing rules for control charts,
 295–296
 servers, 345, 349–350
 service capacity, 345–347
 service level and inventory
 management, 253, 267
 service-mix adjustment, 206
 service patterns, 352–353
 service position, 113
 SES (single exponential smoothing),
 22–25
 SEST (single exponential smooth-
 ing with trend), 30–33, 34
 shadow prices, 234

Shewhart, W., 2
 shift length, 178–182
 shortage costs, 256
 shortest case first scheduling
 method, 189
 simplex method, 232–235
 simulation
 Monte Carlo technique, 376–384
 overview of, 373
 performance measures and,
 384–385
 process of, 373–376
 simultaneity of production and
 consumption of services, 7
 single exponential smoothing (SES),
 22–25
 single exponential smoothing with
 trend (SEST), 30–33, 34
 single-line systems, 349
 single sourcing, 251–252
 Six-Sigma, 278–279
 skill mix, 199
 skill-mix adjustment, 202
 Skinner, Wickham, 220
 slack, 234, 318–319
 socio-technical approach to job
 design, 127
 “spikes” in data, 13
 stability of schedule, 178
 Stack, R. Timothy, 79
 staffing
 external work standards and,
 169–171
 internal workload standards,
 development of, 161–169
 overview of, 152–153
 patient acuity systems and,
 155–161
 skill mix and, 199
 workload management, 153–154
 workload standards and, 154–155
 See also scheduling staff
 staff relief agencies, 184
 staggered start system, 182
 standard deviation approach to
 mean charts, 287–289
 standard elemental times, 132
 standardization of health care, 8
 standardized cost of labor
 adjustment, 204–205
 standard normal distribution
 $P(-3.5 < z < 3.5)$, 391–392
 $P(0 < z < x)$, 389–390

standards
 acuity-adjusted standards,
 155–156
 acuity-based workload, 166–167
 external work, 169–171
 industry, 169
 predetermined, 134
 professional, 169–170
 workload, staffing levels and,
 154–155
 See also internal workload
 standards
 states of nature, 52, 53, 59
 steady state, 355
 stockless inventory, 250–251
 stopwatch time studies.
 See time studies
 straight line distance, 112
 strategic level of decision, 52
 structure-process-outcome
 model, 273
 subjective probability distribution,
 59–60
 suboptimization, 51–52
 supply chain
 distributors, wholesalers, and
 electronic data interchange,
 246–247
 e-distributors, 248
 flow of materials, 248–249
 group purchasing organizations
 (GPOs), 247–248
 management issues, 249
 manufacturers/suppliers, 245–246
 overview of, 244
 upstream and downstream links
 in, 244–245
 surgical suite scheduling
 assessing alternatives, 192
 block method, 188–189, 190–191
 dynamic block method, 189
 estimating procedure times,
 192–193
 first come/first served method,
 188
 longest case first method, 189
 multiple room system, 189, 192
 overview of, 187–188
 shortest case first method, 189
 top down/bottom up method, 189
 surplus, 234
 systematic layout planning, 105
 system utilization measure, 355

T

Taylor, Frederick Winslow, 2, 125, 128

t distribution, 397–398

teams, managing on projects, 310–311

technical efficiency, 215–216

ten-hour shift, 178–182

theoretical distribution, 378

time-based system for compensating employees, 147

time horizon for forecast, establishing, 11

time series method, 13

time standard

- description of, 128
- predetermined standards, 134
- standard elemental times (historical times) and, 132
- stopwatch time studies and, 128–132, 133, 134, 135

time studies

- workload standards and, 163
- work measurement and, 128–132, 133, 134, 135

top down/bottom up scheduling method, 189

total cost, 260–261

total productivity measure, 198

total quality management (TQM), 122, 276–277

tracking signal, 43–44

training observers for work sampling, 136–137

transfers, 172

trend

- definition of, 13, 14
- exponential smoothing, trend-adjusted, 30–33, 34
- linear regression, forecasting techniques based on, 25–30, 31

trigger amount, 266

twelve-hour shift, 178, 179–182

Type I and Type II errors, 282

U

uncertainty in decision milieu, 52–53

understocking, 252

underutilization of health care system, 274

Uniform Code Council, 255

unit of service, 154

Universal Product Code (UPC), 254–255

upper confidence level (UCL), 280–282

utilization of employees, 163–165

V

variable activity, 161

variables, control charts for, 286–291

vendors

- prime, 250
- single versus multiple, 251–252

W

waiting costs, 347

waiting lines, 345–346.

See also queuing models

weighted average utilization of employees, 163, 164

weighted moving average (WMA), 19–22

wholesalers for medical supplies, 246–247

WinQSB software

- Critical Path Method and, 319–320
- decision tree and, 65, 67
- economic order quantity (EOQ) model and, 263–265
- Forecasting Setup window, 16–17, 18
- linear programming module of, 232–235, 237, 239
- locating facilities and, 95, 96
- multi-channel infinite-source queuing model and, 360–363
- overview of, xxi
- payoff table and, 65–67
- probabilistic approach and, 327, 328, 329
- process layout and, 112–113, 114
- Results, Show Forecasting in Graph command, 17, 19
- single channel infinite-source queuing model and, 358–360
- Solve and Analyze, Estimation and Prediction command, 28

Solve and Analyze command, 16

Squared Euclidian Distance option, 95

Weighted Moving Average option, 21–22

WMA (weighted moving average), 19–22

work design

- job design, 125–128
- overview of, 124–125
- work simplification, 142–146
- See also* work measurement

work distribution charts, 142–144

work force, 4, 5

workforce values, 186

working conditions, 128

workload management

- external work standards and, 169–171
- internal workload standards, development of, 161–169
- overview of, 153–154
- patient acuity systems and, 155–161
- productivity and, 171–172
- workload standards and, 154–155

workload stability index, 168

workload standards

- external, 169–171
- internal, development of, 161–169
- staffing levels and, 154–155

workload volume fluctuations, 172

work measurement

- time standards, using, 128–134
- work sampling, using, 134–142

work sampling

- determining sample size for, 137–138
- overview of, 134–136
- random observation schedule for, 138–142
- training observers, 136–137
- workload standards and, 163
- work simplification, 142–146, 172

workstations in product layout, 104

workweek, 178–182

Z

zone tests, 294–295